MEMORANDUM REPORT ARBRL-MR-03151

A UNIFORM FORMAT FOR EXPERIMENTAL DATA

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A flexible form for packaging experimental data sampled at equally-spaced time intervals is developed. The format is designed for transmission to and use by FORTRAN digital computer programs. A sample data listing is provided.

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I. INTRODUCTION

A flexible form for packaging experimental data sampled at equally-spaced time intervals for transmission to and use by FORTRAN digital computer programs is outlined. If adhered to, this proposed standard would allow the distribution of data acquired at various sites to be exchanged with other installations for immediate use or translation to desired formats. Although neither completely universal in scope nor free from all representational and other computer-vs-computer differences, the format has been designed for as widespread a mini- and mainframe-compatibility as possible. Distribution using this format has been successful by means of magnetic tape and direct transmission via data communications line, but punch cards or other media can be employed as well.

II. OVERALL ORGANIZATION

To sidestep the problems of computer word length, internal representation, and file structure, the information is in the form of character-formatted, 80-column cards or card images. Each data acquisition is written as a separate file with no subdivisions by special sentinels but, where applicable, terminated by a single end-of-file. These restrictions reduce any compatibility problems to the seemingly irreducible ones of character code employed and, in the event magnetic tape is the distribution medium, blocking, number of tracks, etc. Naturally, the donor and recipient of any tape must agree on these points.

III. DATA FORMAT

The format includes a certain amount of purely descriptive information plus sufficient data to transform the supplied raw data values to physical units. Data layout is depicted in Figure 1 where the usual FORMAT specifiers of FORTRAN are observed. The first card (or card image) contains overall information. The first field of five columns contains an integer, currently 2, designating the version of the file format. This will be changed if the structure is ever altered. The next 30 columns contain the name of the experimental project. This is followed by the date and time of the event, and a sequence number to distinguish this particular acquisition from any others in the same series or project. Finally, the last field indicates how many A-D converters or other data-gathering devices were utilized for capturing the event. This number is naturally at least 1, but would be greater if several separate recording instruments were employed.

Following this first card are as many groups of cards as instruments used, one per device, each group of cards embodying the complete data from a single such device. The first card in each group provides overall information about the data-recorder. The first field is reserved for its name or description. The second notes the number of data channels. Next follow fields containing the number of calibration values per channel, the number of data values per channel, the time (ms) between

1st card of file

file version I5	project name A30	date A10	time A10	ident no. I5	no. devices I5	unused

1st card of each group

device name A10	chans I5	cal wds I5	data words I10	time between samples E15	offset time E15	words per card I5	data format A10	unused

1st card of each subgroup

channel description A20	quantity & units A20	gage type A20	cal code I5	baseline I5	unused

2nd card

top step gage response E15	0-deg cal coeff E15	1-deg cal coeff E15	2-deg cal coeff E15	0-deg trans coeff E15	unused

3rd card

1-deg trans coeff E15	2-deg trans coeff E15	unused

all succeeding cards in each subgroup

- - - calibration and data words - - -

Figure 1. Card Schematics

consecutive samples in each channel, and the offset time (ms) from some initial experiment zero time to the start of the data in each channel. The final two fields specify the number of calibration and data values per card and the format to be employed in reading them. This format should be floating point to allow the application program to be perfectly general. For raw data expressed in integers, a zero-decimal format, such as (16F5.0), should be used.

Following the group card are subgroups of cards, one for each data channel on the recording device. Each subgroup is itself headed by three cards completely describing the associated channel. The remainder of each channel subgroup is a series of cards containing the calibration values, if any, followed by the data values, all written according to the specifications present on the group card as described above.

The first subgroup card contains descriptive information about what was measured on that channel, the physical quantity and units of the transformed data, and the transducer used. The fourth field is coded 1 if the channel is calibratable or 0 if it is not. The last field supplies the raw-data baseline in A-D counts from the calibration or a zero if the channel is not a calibratable one. The second and third subgroup cards provide all information necessary to transform the data values to physical units. The first field contains the value, in electrical units, of the highest step in the calibration. The next three fields contain the quadratic calibration coefficients used to convert each raw datum - offset by the baseline - into electrical units. Finally, the last field on the second card and the two fields on the third contain the quadratic transformation coefficients used to convert electrical units to physical units. That is, if a raw datum is given by "d", the baseline by "k", and the above-mentioned coefficients by "a", "b", "c", "α", "β", "γ", respectively, then,

$$D = f(g(d-k))$$

yields the transformed datum D in physical units where

$$g(x) = a+bx+cx^2, \quad x = d-k$$
$$f(y) = \alpha+\beta y+\gamma y^2, \quad y = g(x)$$

Should the channel be uncalibratable, supply a = 0., b = 1., c = 0. It is understood that the donor should provide all the information necessary to transform the data. The calibration values are passed on to allow the recipient to re-calibrate if desired using, perhaps, preferred fitting algorithms.

IV. EXAMPLE

Figure 2 depicts an excerpt from a data file created in the manner described as an example of the application of the procedure.

```
   2     40 MM HIGH BURNING RATES 26-MAR-80   12:58:10    5    1
PHOENIX1       2  350      12288    2.50000E-03    0.00000E-01   16(16F5.0)
PRESSURE AT IG END  PRESSURE (MPA)       PCB 118A                    1   88
    7.00000E 03     0.00000E-01    8.24308E 00   -1.09966E-04    1.73760E-01
    5.71250E-02    -1.67650E-07
    0   87   89   89   91   91   91   89   88   91   89   92   88   89   91   89
   91   88   88   87   89   89   89   89   89   89   91   91   89   89   88   91
   88   89   89   88   88   89   91   89   89   88   91   88   91   89   89   89
   89  259  257  256  259  257  259  259  259  259  257  262  259  260  259  259
  262  260  259  259  259  259  259  262  259  259  259  260  259  260  260  259
  259  262  259  260  259  257  259  259  259  260  259  259  259  262  259  259
  259  268  430  428  430  428  428  428  430  431  430  430  430  432  431  430
  431  428  431  431  431  431  428  428  430  432  432  432  431  430  431  431
  431  430  431  432  432  431  428  428  430  431  431  431  432  431  431  430
  431  431  432  430  430  431  432  599  598  599  599  600  600  600  601  600
  601  601  599  600  600  601  604  600  600  600  600  601  601  601  600  600
  601  604  601  603  599  601  601  601  600  599  600  601  604  601  600  601
  601  603  601  729  772  771  772  774  771  774  775  774  774  774  775  775
  772  771  775  775  775  774  772  775  774  774  774  772  775  775  775  772
  774  774  775  776  774  775  775  774  776  777  775  774  774  776  775  775
  774  775  775  775  777  774  776  945  944  945  947  945  947  948  947  947
  945  947  947  950  948  947  947  947  947  947  947  945  945  947  947  947
  947  947  951  949  948  952  948  944  947  949  950  948  947  947  949  948
  948  948  948  947  947  947  950   95   96   95   96   94   92   92   89   89
   92   91   91   91   89   92   92   91   89   89   88   89   89   88   88   88
   91   91   89   89   89   89   89   91   88   89   88   91   91   91   88   87
   88   88   88   89   89   88   88   88   89   88   88   89   88   89    0   89
   88   88   88   88   88   89   91   89   88   88   89   91   91   89   89   89
   89   91   91   89   89   89   91   91   89   89   89   89   91   89   89   88
   88   89   89   89   89   88   88   89   89   89   88   87   88   89   91   89
   89   89   89   89   91   92   91   89   88   89   89   89   89   88   89   89
   89   91   89   88   89   89   91   89   89   89   89   88   89   89   88   88
   89   91   89   88   89   88   89   91   89   89   89   89   89   89   89   89
   89   89   89   89   89   89   89   89   88   88   89   91   91   89   89   91
   91   91   89   89   89   89   89   91   88   88   89   89   91   89   88   88
   88   88   88   91   92   89   88   89   89   91   89   88   88   91   92   91
   91   89   89   89   89   91   89   89   89   89   91   89   89   89   88   88
   89   89   89   89   89   89   89   89   89   89   91   89   89   89   88   89
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Figure 2. File Example

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